Response of Freesia (Freesia hybrida) to spraying with an organic acid (Laq-Humus) and chelated iron and their effect on growth and flowering indicators

Jamal Ahmed Abbass Mushtaq Talib Hammadi AL- Zurf Atheer Turki Ajami
College of Agriculture, University of Kufa, Iraq.

ABSTRACT

An experiment was conducted in the nursery of the college of Agriculture, University of Kufa during the agricultural season (2017-2018) in a house covered with green saran to study the effect of spraying organic acid (Lag-Humus) and chelated iron (Fe 6%, EDTA) on the growth and flowering indicators for freesia. The experiment was conducted according to The Randomized Complete Block Design (RCBD), with three replicates and two factors. The first factor is spraying three concentrations of organic acid, which are (3, 0 and 6 $ml.L^{-1}$) and the second factor is spraying three concentrations of chelated iron are (0, 20 and 40 $ml.L^{-1}$). The averages were compared according to the Least Significant Difference Test (L.S.D) and at a probability level of 0.05. The results also showed that spraying organic acid at a concentration of (6 $ml.L^{-1}$) with chelated iron at a concentration of (40 $mg.L^{-1}$) significantly increased the dry weight of the total vegetative, the leaves content of total chlorophyll, floret diameter, the length of the flower inflorescence, vase life and the leaves content of iron which amounted to (1.75 g, 49.78 mg.100 g^{-1}, 6.13 cm, 9.00 days and 47.50 $mg.kg^{-1}$), respectively compared to the plants of control treatment, which gave the lowest values amounted to (1.01 g, 44.46 mg. 100 g^{-1}, 3.23 cm, 6.33 days and 36.82 $mg.kg^{-1}$). while spraying the organic acid at a concentration of (6 $ml.L^{-1}$) with chelated iron at a concentration of (20 $mg.L^{-1}$) significantly increased the number of leaves per plant, the leaves content of the total soluble Carbohydrate, the number of flower inflorescences per plant, the number of florets per flower, and the percentage of nitrogen and reduced the number days required to open the first floret which amounted to (8.33 leaves and 6.34 $mg.kg^{-1}$ dry weight, 5.66 inflorescences, 12.33 florets, 2.03% 128.33 days), respectively compared to the control treatment, which gave the lowest values amounted to (3.00 leaves, 4.20 $mg.kg^{-1}$ dry weight, 2.33 inflorescences, 6.00 florets, 0.62%), respectively and the highest average in the number of days required to open the first floret amounted to (138.00 days).

Keywords: growth stimulators, iron, floriculture bulbs.

استجابة نبات الفريزيا *Freesia hybrida* للرش بالحامض العضوي Laq-Humus والحديد المخلبي واثرهما في مؤشرات النمو والأزهار

جمال أحمد عباس مشتاق طالب حمادي الزرفي أثير تركي عجمي
كلية الزراعة, جامعة الكوفة, جمهورية العراق

المستخلص:

أجريت تجربة في مشتل كلية الزراعة /جامعة الكوفة خلال الموسم الزراعي 2017- 2018 في بيت مغطى بالساران الأخضر لدراسة تأثير رش الحامض العضوي Lag- Humus والحديد المخلبي(Fe 6%, EDTA) في مؤشرات النمو والأزهار لنبات الفريزيا. نفذت التجربة بتصميم القطاعات العشوائية الكاملة (R.C.B.D) بثلاث مكررات بعاملين, الأول رش ثلاثة تراكيز من الحامض العضوي وهي (3, 0 و 6) مل.لتر$^{-1}$, والثاني رش ثلاثة تراكيز من الحديد المخلبي هي (0, 20 و 40) ملغم.لتر$^{-1}$. قورنت المتوسطات حسب اختبار أقل فرق معنوي (L.S.D) وعلى مستوى احتمال 0.05 .أظهرت النتائج كذلك أن رش الحامض العضوي بتركيز 6 مل.لتر$^{-1}$ مع الحديد المخلبي بتركيز40 ملغم.لتر$^{-1}$ زاد معنويا من الوزن الجاف للجموع الخضري, محتوى الاوراق من الكلوروفيل الكلي, قطر الزهيرة, طول النورة الزهرية, العمر المزهري ومحتوى الاوراق من الحديد اذ بلغت 1.75غم, 49.78ملغم.100غم$^{-1}$, 6.13سم, 9.00يوم و47.50ملغم.كغم$^{-1}$مقارنة مع النباتات المقارنة والتي أعطت اقل القيم بلغت(1.01غم, 44.46ملغم.100غم$^{-1}$, 3.23سم, 6.33يوم و 36.82ملغم. كغم$^{-1}$. في حين ان رش الحامض العضوي بتركيز 6 مل.لتر$^{-1}$ مع الحديد المخلبي بتركيز 20ملغم.لتر$^{-1}$ زاد معنويا من عدد الاوراق لكل نبات ومحتوى الاوراق من الكربوهيدرات الكلية الذائبة, عدد النورات

 ISSN 2072-3875

الزهرية لكل نبات و وعدد الزهيرات لكل نورة والنسبة المئوية للنتروجين وقلل من عدد الأيام ألازمه لتفتح اول زهيرة إذ بلغت 8.33ورقة و 6.34ملغم.غم$^{-1}$ وزن جاف, 5.66نورة زهرية, 12.33زهيرة, 2.03% 128.33يوم مقارنة مع معاملة المقارنة والتي اعطت اقل القيم(3.00ورقة, 4.20ملغم.غم$^{-1}$ وزن جاف, 2.33 نورة زهرية, 6.00 زهيرة, 0.62% وأعلى معدل في عدد الأيام اللازمة لتفتح اول زهيرة بلغ 138.00 يوم) وعلى التوالي.

الكلمات المفتاحية: محفزات نمو, حديد, ابصال زينة

1. INTRODUCTION

Freesia belongs to the Iridaceae family, which is an annual winter corm plant. Southern Africa is its origin country. Its leaves are thin and acute, with a Trumpet flower that carries corymb inflorescences with different colors (yellow, orange, white, and red). It has an aromatic smell. The plants bloom during the spring and it is suitable for commercial cut flowers (Mahmood and Amin, 1989; Al-Batal, 2005). They come economically after clove flowers in Europe and are mainly grown for the production of potted plants and cut flowers (Salunkhe et al., 1989). It is cultivated in places without frost and protected from strong winds, especially during flowering, and it prefers cultivating it in light soils rich in organic materials (Al-Batal, 2010). Organic fertilizers are defined as a mixture of residues of materials in the soil and from plant and animal wastes, fermented fertilizers (compost), green fertilizer, and other microorganisms that have resulted from degradation processes (Al-Radhiman, 2004; Bailey, 2006). Humic acid is considered one of the humic compounds resulting from the decomposition of the organic matter where it helps in improving the absorption of nutrients in the soil and improving soil texture. The humic substance also helps in increasing the amino acids and the plant content of proteins and nutrients (Pettit, 2003). It also has a role in inhibiting the activity of the enzyme (IAA oxidase) and increasing the activity of Auxin, which plays a role in stimulating plant growth and works as a bio-catalyst stimulating hormonal activity for the plant, since it liberates many types of auxins that help in regulating plant growth, stimulating the physiological functions of the plant and stimulating cell division and elongation. It also plays a role in delaying the analysis of proteins and chlorophyll and increasing the production of vitamins and hormones (ODell, 2003). Iftikhar et al., (2013) indicated that spraying Gladiolus grandiflorus plants with Humic acid at a concentration of (2 mm.L^{-1}) led to a significant increase in the number of leaves per plant, the leaves content of total chlorophyll, and the number of florets per flower inflorescence. Al-Bayati and Khalifa, (2017) also found when spraying humic acid on the bulbs of Narcissus (Narcissus spp.) at a concentration of (1 g.L^{-1}) led to a significant increase in the plant height, the number of leaves, the flower diameter and the length of the flower stalk. Studies indicate the importance of foliar nutrition for the plant, where it is resorted to when obstructing the absorption process of nutrients through the roots (Al-Sahaf, 1989), where the macro and micronutrients have an important role in the growth and development of plants, and Its presence in concentrations less than the need of the plant leads to poor growth and production, so the plant must be supplied with its need of these elements (Pritts and Geolf, 1993), to improve its growth and production, and despite the presence of these nutritional elements in the soil in large quantities, the available ones for the plant do not almost correspond to the proportion needed for plant growth, so using foliar spraying on a plant is important for the purpose of rapid response to compensate for the deficiency of these nutrients (Taiz and Zeiger, 2006). Iron is an important element that affects the growth of the plant where it has an impact on many bioprocesses for the plant, either through its direct participation as a structural part for plant materials or its activation of enzymatic processes within the plant. Iron enters as an agent and activator for reactions of forming Chlorophyll Pigments through a series of compounds that end up with the formation of a chlorophyll molecule (Hopkins, 1999) in addition to its role in the process of RNA representation of chloroplasts in leaves, which are bodies containing chlorophyll (Rout and Sahoo, 2015). It also enters into the formation of cytochromes (Cytochromes) of great importance in photosynthesis and respiration, where iron plays a role in the NADH + reduction process, which leads to the production of energy needed for photosynthesis (Kabata-Pendias and Pendias, 1992). Al-Asadi (2014) showed when spraying chelated iron on the Clendula officinalis L. plant at a concentration of (200 mg.L^{-1}) led to a significant increase in the number of leaves, the leaves content of total chlorophyll, the number of flowers, and flower diameter. For the importance of freesia plant being one of the important cut flowers, this experiment was conducted to demonstrate the effect of spraying Freesia (Freesia hybrida) with an organic acid (Laq-Humus) and chelated iron on growth and flowering indicators.

2. MATERIALS AND METHODS

The experiment was conducted at the nursery of the College of Agriculture, University of Kufa during the agricultural season (2018-2019) to demonstrate the effect of spraying Freesia (Freesia hybrida) with an organic acid (Laq-Humus) and chelated iron on growth and flowering indicators. The corms were planted on 10/15/2018 in plastic pots with a diameter of 22 cm and a height of 19 cm in which a soil with a size of (3.5 kg). Table (1) shows the Physical and chemical traits for the soil of flowerpots.

Table 1: some physical and chemical traits for the soil of flowerpots.

Traits	Units	Value
Degree of soil interaction	pH	7.31
Electrical conductivity	dS.m^{-1}	2.63
N	g.100 kg^{-1}	0.51
P	mg.L^{-1}	2.65
K	Cmol.kg^{-1}	14.3
Mg ++		1.8
Organic matter	%	0.95
Texture	**Sand**	
Clay	%	3.0
Silt	%	4.3
Sand	%	92.7

The experiment was conducted according to The Randomized Complete Block Design (RCBD), with three replicates and two factors: the first factor is organic acid Laq-Humus (German origin, produced by the company (BBA GERMANY) that distributed by the Lebanese Unifert Sal Businesses Company, which includes organic acids (humic acid and Fulvic acid) with the percentage of 18% that extracted from the brown coal Leonardite which It was formed through chemical and bio-processes to convert organic and plant residues into humus) with three concentrations (0, 3 and 6 ml.L^{-1}) and the second factor is chelated iron in three concentrations (0, 20 and 40 mg.L^{-1}), spraying Laq-Humus acid and chelated iron (Fe 6% EDTA) three times, the first one after the real leaves appear on the corms, and the second one after 15 days of the first one, and the third spraying is after 15 days from the second spraying. The averages were compared according to the least significant difference (S.D.L) test at the probability level of (0.05) (Al-Rawi and Khalaf Allah, 2000). All service operations were performed such as irrigation and weeding and for each experimental unit whenever the plant needed it. On 6/1/2019 the following growth indicators were measured.

First: vegetative growth indicators:

ISSN 2072-3875

1- **Total number of leaves per plant (leaves.plant^{-1})**
2- **The dry weight of total vegetative (g)**

The dry weight was calculated at the end of the experiment, where the total vegetative was dried in a room with good ventilation and placed in the oven for 48 hours, after which the weight was calculated by a sensitive balance.

3- **The Leaves content of total chlorophyll (mg.100 g^{-1} fresh weight)**

Chlorophyll was estimated according to (Goodwin, 1976) method by a UV-Visible spectrophotometer to measure the optical absorption of the two-wavelength (645 and 663 nm) in the graduate laboratory of the College of Agriculture, University of Kufa.

4- **The content of total soluble Carbohydrate (mg.g^{-1}):**

Carbohydrates were estimated using (Duboies et al., 1956) method by UV-Visible spectrophotometer along 490 nm wavelength.

Second: indicators of flower growth

1- **The number of days required to open the first floret (day)**

The number of days was calculated from the cultivation of corm to blooming the first floret on the plants.

2- **The number of flower inflorescences (inflorescences.plant^{-1}).**
3- **The number of florets (florets.inflorescences^{-1}).**
4- **The diameter of inflorescences (cm)**

The diameter of the floret was measured from the two largest points by Vernier caliper.

5- **The length of the flower stalk (cm)**

The length of the flower stalk was measured by the tape measure.

6- **The diameter of the flower inflorescence stalk (mm)**

The diameter of the flower inflorescence stalk was measured by Vernier Caliper.

7- **Vase life (day):**

After the flowering is complete, the flowers are cut completely from the area of their contact with the stem and the cutting was with a sharp scalpel. The process cut flower took place in the afternoon and the cutting was at an angle of 45º, after which the flowers were placed directly in a clean and sterile container with the size of 500 cm^3 filled with distilled water and added to it 1% sugar and aspirin tablet to each container that contains the active substance (salicylic acid) (Sultan et al., 1992). The flower stalk was then immersed in the solution and the leaves were removed from the lower third of the flower stalk (Ismail, 2004). The preservative solution was replaced every two days, with a cut of poison from the base of the flower stalk, and according to the number of days that the flower remained fresh in the atmosphere of the usual room 20-22 m while keeping its vitality so that it can be used in coordination.

Third: The leaves content of nutrients

1- The leaves content of the nitrogen component (%): the nitrogen was estimated using the Kjeldahl apparatus according to what the press reported (1989).
2- The leaves content of the iron element (mg.kg^{-1}): The leaves content of the iron element was estimated from the element iron according to what was reported (by Al-Sahaf, 1989) by taking the digested sample and measured by Atomic Absorption Spectrophotometers.

3. RESULTS AND DISCUSSION

Table (2) shows a significant increase in the indicators of vegetative growth for Freesia when spraying it with organic acid at a concentration of (6 ml.L^{-1}), where the number of total leaves, the dry weight of the total vegetative, and the leaves content of the total soluble Carbohydrate amounted to (7.00

ISSN 2072-3875

leaves.plant^{-1}, 1.61 g, 48.59 mg.100 g^{-1}, and 5.97 mg.g^{-1}), respectively compared to the spraying treatment with distilled water only, which gave the lowest averages amounted to (3.33 leaves.plant^{-1}, 1.06 g, 44.73 mg. 100 g^{-1}, and 4.37 mg.g^{-1}), respectively. The results of the same table showed that spraying iron with a concentration of (20 mg.L^{-1}) led to a significant increase in the number of leaves and the leaves content of total soluble carbohydrates which amounted to (5.44 leaves.plant^{-1} and 5.34 mg.g^{-1}), While the results showed a significant increase in the dry weight of the total vegetative and the leaves content of the total chlorophyll pigment when spraying at a concentration of (40 mg.L^{-1}) which amounted to (1.39 g and 47.26 mg. 100 g^{-1}) compared to the control treatment that gave the lowest averages amounted to (4.33 leaves.plant^{-1}, 1.22 g, 45.74 mg. 100 g^{-1}, 5.08 mg.g^{-1}), respectively. It is also observed from the results of Table (2) that spraying the organic acid at a concentration of (6 ml.L^{-1}) with iron at a concentration of (20 mg.L^{-1}) led to a significant increase in the number of leaves and the leaves content of total soluble carbohydrates amounted to (8.33 leaves.plant^{-1} and 6.34 mg.g^{-1}). The results also showed a significant increase in the dry weight of the total and the leaves content of the total chlorophyll when spraying it with organic acid at a concentration of (6 ml.L^{-1}) with iron at a concentration of (40 mg.L^{-1}) which amounted to (1.75 g and 49.78 mg. 100 g^{-1}) compared to the control treatment that gave the lowest averages amounted to (3.00 leaves.plant^{-1}, 1.01 g, 44.46 mg. 100 g^{-1}, and 4.20 mg.g^{-1}), respectively.

Table 2: shows the effect of spraying organic acid and chelated iron on vegetative growth indicators.

Treatments			**Number of leaves (leaves.plant^{-1})**	**The dry weight of the total vegetative (g)**	**The leaves content of the total chlorophyll (mg.100 g^{-1})**	**The leaves content of the total soluble Carbohydrate (mg.g^{-1})**
organic acid (ml.L^{-1})		0	3.33	1.06	44.73	4.37
		3	4.77	1.23	46.25	5.26
		6	7.00	1.61	48.59	5.97
L.S.D. 0.05			**0.402**	**0.047**	**0.550**	**0.193**
chelated iron (mg.L^{-1})		0	4.33	1.22	45.74	5.08
		20	5.44	1.29	46.56	5.34
		40	5.33	1.39	47.26	5.18
L.S.D. 0.05			**0.402**	**0.047**	**0.550**	**0.193**
organic acid (ml.L^{-1}) × chelated iron (mg.L^{-1})	0	0	3.00	1.01	44.46	4.20
		20	3.33	1.07	44.77	4.38
		40	3.66	1.11	44.95	4.55
	3	0	4.33	1.16	45.59	5.02
		20	4.66	1.21	46.10	5.31
		40	5.33	1.32	47.06	5.46
	6	0	5.66	1.48	47.16	6.04
		20	8.33	1.61	48.82	6.34
		40	7.00	1.75	49.78	5.55
L.S.D. 0.05			**0.696**	**0.082**	**0.953**	**0.335**

Table (3) shows when spraying the organic acid with a concentration of (6 ml.L^{-1}) led to a significant increase in the traits of flower growth, where it led to a decrease in the number of days required to open the first floret and an increase in the number of flower inflorescences, the number of florets, the diameter of the floret, the length of the flower inflorescence, the

ISSN 2072-3875

diameter of the flower stalk, and the vase life, which amounted to (130.00 days, 5.22 inflorescence.plant^{-1}, 10.89 floret.inflorescence^{-1}, 5.73 cm, 35.50 cm, 5.85 mm, and 7.88 days), respectively compared to the control treatment that gave the highest average number of days required to open the first floret and the lowest average for the rest of the indicators, which amounted to (137.78 days, 2.77 inflorescence.plant^{-1}, 6.11 floret.inflorescence^{-1}, 3.42 cm, 27.09 cm, 5.18 mm, and 6.66 days), respectively. The same table shows when spraying iron with a concentration of (20 mg.L^{-1}) led to reducing the number of days required to open the first floret and increasing the number of flower inflorescences and the number of florets which amounted to (133.33 days, 4.22 inflorescences.plant^{-1} and 8.44 floret.inflorescence^{-1}). The results also showed a significant increase when spraying iron with a concentration of (40 mg.L^{-1}), where the diameter of the flower, the length and diameter of the flower inflorescence, and the vase life have increased which amounted to (4.88 cm, 31.82 cm, 7.80 mm and 9.00 days), respectively compared to the control treatment that gave the highest average number of days required to open the first floret and the lowest average for the rest of the indicators which amounted to (134.78 days, 3.55 inflorescences.plant^{-1}, 7.33 florets.inflorescence^{-1}, 4.08 cm, 29.34 cm, 3.53 mm, and 6.33 days), respectively.

Table (3) shows that spraying organic acid at a concentration of (6 ml.L^{-1}) with iron at a concentration of (20 mg.L^{-1}) led to reducing the number of days required to open the first florets, increase the number of flower inflorescences, the number of florets which amounted to (128.33 days, 5.66 inflorescences.plant^{-1}, 12.33 florets.inflorescence^{-1}), respectively. The results also showed a significant increase when spraying with organic acid at a concentration of (6 ml.L^{-1}) and with iron at a concentration of (40 mg.L^{-1}), where the diameter of the floret, the length and diameter of the flower inflorescence, and the vase have increased which amounted to (6.13 cm, 36.53 cm, 7.88 mm and 9.00), respectively compared to the control treatment, which gave the highest number of days required to open the first floret and the lowest averages for the rest of the indicators which amounted to (138.00 days, 2.33 inflorescences.plant^{-1}, 6.00 floret.inflorescence^{-1}, 3.23 cm, 26.23 cm, 5.53 mm, and 6. 33 days), respectively. Table (4) shows the positive effect when spraying organic acid at a concentration of (6 ml.L^{-1}) on the Freesia plant, which led to a significant increase in the percentage of nitrogen and the leaves content of iron which amounted to (1.87% and 46.00 mg.kg^{-1}) compared to the control treatment Which gave the lowest values amounted to (0.88% and 39.27 mg.Kg^{-1}), respectively. The results of the same table showed when spraying iron with a concentration of (40 mg.L^{-1}) led to a significant increase in the percentage of nitrogen and the leaves content of nitrogen and iron, which amounted to (1.48% and 43.47 mg.kg^{-1}) compared to the control treatment that gave the lowest values amounted to (1.13% and 41.77 mg.kg^{-1}), respectively. It is noted from the results of Table (4) that there is a significant increase when spraying the organic acid at a concentration of (6 ml.L^{-1}) with iron at a concentration of (20 mg.L^{-1}) on the Freesia plant led to an increase in the percentage of nitrogen in the leaves which amounted to (2.03%). Likewise, there was a significant increase in the leaves content of iron when spraying organic acid at a concentration of (6 ml.L^{-1}) with iron at a concentration of (40 mg.L^{-1}) which amounted to (47.50 mg.kg^{-1}) compared to the control treatment that gave the lowest values amounted to (0.62% and 38.62 mg.kg^{-1}), respectively.

Table 3: shows the effect of spraying organic acid and chelated iron on the flower growth indicators.

Treatments		Concentration	number of days required to open the first floret (day)	number of flower inflorescences (inflorescences.plant^{-1})	number of florets (floret.inflorescence^{-1})	the diameter of the floret (cm)	length of the flower inflorescence (cm)	the diameter of the flower stalk (mm)	Vase life (day)
organic acid (ml.L^{-1})		0	137.78	2.77	6.11	3.42	27.09	5.18	6.66
		3	133.67	4.00	7.11	4.40	29.53	5.39	7.59
		6	130.00	5.22	10.89	5.73	35.50	5.85	7.88
L.S.D. 0.05			**0.561**	**0.456**	**0.976**	**0.293**	**0.779**	**0.219**	**0.499**
chelated iron (mg.L^{-1})		0	134.78	3.55	7.33	4.08	29.34	3.53	6.33
		20	133.33	4.22	8.44	4.57	30.96	4.83	7.66
		40	133.33	4.22	8.33	4.88	31.82	7.80	9.00
L.S.D. 0.05			**0.561**	**0.456**	**0.976**	**0.293**	**0.779**	**0.219**	**0.499**
organic acid (ml.L^{-1}) × chelated iron (mg.L^{-1})	0	0	138.00	2.33	6.00	3.23	26.23	3.53	6.33
		20	138.11	2.66	6.00	3.40	26.97	4.83	7.66
		40	136.67	3.33	6.33	3.63	28.07	4.80	7.00
	3	0	134.17	3.66	6.67	3.90	28.50	4.53	6.33
		20	133.62	4.33	7.00	4.40	29.23	5.83	7.66
		40	132.67	4.00	7.67	4.90	30.87	6.80	9.00
	6	0	131.00	4.66	9.33	5.13	33.30	6.53	6.33
		20	128.33	5.66	12.33	5.93	36.17	5.83	7.66
		40	130.58	5.33	11.00	6.13	36.53	7.88	9.00
L.S.D. 0.05			**0.971**	**0.790**	**1.690**	**0.509**	**1.349**	**0.380**	**0.865**

ISSN 2072-3875

Table 4: shows the effect of spraying organic acid and chelated iron on the leaves content of iron and the percentage of nitrogen.

Treatments		Concentrations	the percentage of nitrogen (%)	the leaves content of iron ($mg.kg^{-1}$)
organic acid ($ml.L^{-1}$)		0	0.88	39.27
		3	1.21	42.02
		6	1.87	46.00
L.S.D. 0.05			**0.188**	**0.524**
chelated iron ($mg.L^{-1}$)		0	1.13	41.77
		20	136	42.05
		40	1.48	43.47
L.S.D. 0.05			**0.188**	**0.524**
Organic acid ($ml.L^{-1}$) × chelated iron ($mg.L^{-1}$)	0	0	0.62	38.62
		20	0.81	39.20
		40	1.22	39.99
	3	0	1.08	41.16
		20	1.23	41.99
		40	1.32	42.90
	6	0	1.69	45.54
		20	2.03	44.97
		40	1.91	47.50
L.S.D. 0.05			**0.326**	**0.908**

Tables (2,3 and 4) show that spraying organic acid (Laq Humus) led to a significant increase in the indicators of vegetative and flowering growth, the percentage of nitrogen, and the leaves content of iron. The reason may be due to the role of the organic acid in plant growth through chelating soil nutrients and facilitating the absorption of nutrients Especially nitrogen and phosphorous, which are involved in the synthesis of nucleic acids, proteins, enzymatic companions, all processes and reactions associated with protoplasm, enzymatic reactions, and photosynthesis, as well as have an important and clear role in increasing the number and size of leaf cells and increasing the formation of chlorophyll, which leads to increase the effectiveness of leaves in photosynthesis and then increasing vegetative growth (Nardi, 2002). The acidic media that helps bind to the positive ions also provides and protects the latter from precipitation, where it has a role in increasing the permeability of the cell membrane and its importance in transporting and preparing the micronutrients and absorbing nutrients, phosphates, and oxygen (Mayhew 2004). Humic substances also increase the bioactivity of the plant by activating the enzymatic systems and increasing the formation of DNA, RNA, which in turn creates the cells and also works to stimulate the rapid division of cells, thus encourage lateral growths such as stem diameter, number of branches and number of leaves (Jackson, 1993). The increase in the leaves content of total soluble carbohydrates and total chlorophyll and nutrients such as nitrogen and iron may be attributed to the effect of spraying the organic acid to its content of humic acid and nutrients, which caused the increase in vegetative growth indicators, which increased the rate of photosynthesis in the leaves, thus increasing the amount of manufactured carbohydrates and the leaves content of total chlorophyll. The spraying on the plant and soil also contributed to the direct nutrition with nutrients such as nitrogen, which caused the increase of these elements in the leaves of the plant (Gonzalez et al., 2010). Humic acid leads to the activation of

 ISSN 2072-3875

the physiological functions of the plant and works to increase the plant's biomass by stimulating the division of plant cells and increasing their elongation and size, as well as delaying the decomposition of proteins and chlorophyll and lead to an increase in the production of vitamins and plant hormones for the plants treated with them, thus increasing the size of the total vegetative and improving indicators of flowering growth at the end (O Dell, 2003). It is noted from the tables (2, 3, and 4) that there is a significant increase in the indicators of vegetative and flowering growth and the leaves content of the nutrients when spraying the iron element to the total vegetative. The reason may be due to the role of the iron element that is involved in photosynthesis and the building of nucleic acids, DNA and RNA necessary for cell division, in addition to that it enters in the synthesis of the chlorophyll molecule that is involved in photosynthesis and building materials necessary for the growth of plants (Al-Sahaf, 1989). Likewise, the influence of the iron component on photosynthesis and ATP production is important in plant bio-processes, which encourages the formation of foliar buds and then increase the number of leaves (Abu Dahi and Yunus, 1988). The reason for the increase in the percentage of nitrogen in the leaves is due to the role of added iron in increasing plant growth indicators as shown in Tables (2 and 3). Likewise, increasing nitrogen availability in the soil is due to a decrease in the pH of the soil, thus an increase in nitrogen absorption, which leads to increase nitrogen concentration in the leaves (Marschner, 1995). This may also be due to the effect of the iron element in increasing the number of leaves as shown in Table (2). In addition, the iron element has an important role in the bio-processes inside the plant that accelerate the transformation of some vegetative buds to flower, and then increase the flower buds and increase the number of flowers in the plant (Mengel, 2002). Also, increasing the leaves content of total carbohydrates as shown in Table (2) may eventually lead to an increase in vase life of the flowers.

REFERENCES

1- **Ismail, Shatha Ibrahim. 2004.** Effect of 8-Hqs and sucrose on the vase life of Chrysanthemum coronarium. Iraqi Agricultural Science Journal, 35 (4): 45 - 50.

2- **Abu Dahi, Youssef Mohammed and Muayyad Ahmed Al-Younis, 1988.** Plant nutrition guide. faculty of Agriculture. University of Al Mosul. Ministry of Higher Education and Scientific Research. University of Al Mosul. Iraq.

3- **Al-Asadi, Zainab Nuri. 2014.** effect of spraying with active yeast and iron on vegetative and flowering growth of plant Calendula officinalis L.. Journal of Karbala University Scientific Journal, 12 (3): 226-235.

4- **Al-BataL, Nabil Naim. 2005.** internal Ornamental Plants. College of Agriculture. Publications of the University of Damascus. Al-Ajlouni Press. Syria.

5- **Al-BataL, Nabil Naim. 2010.** external ornamental plants. Publications of the University of Damascus. College of Agriculture. Al-Rawdah Printing Press. Syria.

6- **Al-Sultan, Salem Mohammed; Talal Mahmood Chalabi and Mahmood Dawood Al-Sawaf. 1992.** Decorations. Dar Al-Kutub for Printing and Publishing. University of Al Mosul. Ministry of Higher Education and Scientific Research. Iraq.

7- **Al-Bayaty, Mateen Yilmaz and Ahmed Kamaldeen All-Kalefa. 2017.** Effect Drench Alga 600 and Humic Acid on Growth and Flowering of Two Cultivar From Narcissus Spp.. Tikrit Journal of Agricultural Sciences, special issue of the Sixth Scientific Conference of Agricultural Sciences, 28-29 March 2017, pp. 30-38.

ISSN 2072-3875

8- **Al-Rawi, Khashi Mahmood, and Abdel Aziz Khalaf Allah. 2000.** Design and analysis of agricultural experiments. Dar Al-Kutub for Printing and Publishing. University of Al Mosul. Ministry of Higher Education and Scientific Research. Iraq.

9- **Al-Radhiman, Khaled Bin Nasir, 2004.** Introduction to Organic Agriculture. Scientific Publications Series, Saudi Society for Agricultural Sciences. Eighth Edition. fifth year. King Saud University. Saudi Arabia.

10- **Al-Sahaf, Fadel Hussein, 1989.** Applied Plant Nutrition. College of Agriculture. Baghdad University. Ministry of Higher Education and Scientific Research. Iraq.

11- **Mahmood, Mohsen Khalaf and Sami Kareem Mohammed Amin. 1989.** Ornamental and gardening engineering. Technical Institutes Authority. Technical House. Ministry of Higher Education and Scientific Research. Iraq.

12- **Bailey, D. E. 2006.** Wetland vegetation dynamics ecosystem gas exchange in response to organic matter loading rates. Masters of Science. The Faculty of the School of Marine Science. College of William and Mary. England.

13- **Duboies, M.; K. A. Gilles; J. K. Hamilton; R. A. Robers and Smith, F. .1956.** Colorimetric method for determination of agar and related substance. Anal. An. Chem., 28: 350-356.

14- **Geolf , M : and M. P . Pritts . 1993 .** Phosphorus, zinc and boron influence yield components in early low *Strawberry* . J. Amer. Soc. Hort. Sci., 118(1):43 – 49.

15- **Gonzalez, C., Y .Zheng and C.J . Lovatt** .2010 Properly timed foliar fertilization can and should result in a yield benefit and net increase in grower income .Acta Hort. (ISHS) 868: 273-286.

16- **Goodwin, T.W. 1976 .** Chemistry and biochemistry of Plant Pigments. 2nd ed. Academic Press, N.Y. USA. pp373.

17- **Hopkins , W. G. 1999.** Introduction to Plant Physiology . John Wiley and Son Inc. USA. pp. 512.

18- **Iftikhar, A.; R. U. Saquib; M. Qasim; S. Muhammad; A. S. Khan and Muhammad Y.2013.** Humic acid and cultivar effects on growth, yield, vase life, and corm characteristics of gladiolus. Chilean Journal of Agriculture Research, 73(4):339-344.

19- **Jackson,W. 1993.** Humic, fulvic and microbial balance: organic soil conditioning. Evergreen. Jackson Research Center. Colorado. USA. pp.329.

20- **Marschner , H.1995.**Mineral Nutrition of Higher Plants .2nd ed .Sandiego. Academic Press. USA.pp.710.

21- **Kabata-Pendias, A. and H. Pendias.1992.**Trace elements I soils and plants .Second ed. .CRC Press .Boca Raton , Florida. USA.

22- **Mayhew, L. 2004.** Humic Substances in Biological Agriculture. ACRES USA. A Voice for Eco-Agriculture. 34(1&2):1-8.

23- **Mengel, K., 2002.** Alternative or complementary role of foliar supply in mineral nutrition . Acta Horticlturae, 594:33-48.

24- **Nardi, S.; D. Pizzeghello; A. Muscolo and A. Vianello 2002**. Physiological effects of humic substances on higher plants. Soil Biology and Biochemistry,34:1527- 1536.

25- **O ‹Dell ‹C. 2003.** Natural plant hormones are biostimulants helping plants develop high plant antioxidant activity for multiple benefits . Virginia Vegetable Small and Special Crops, 2:132-141.

26- **Pettit, R. E .2003..** Emeritus Associate Professor Texas A & M university, Organic Matter, Humus, Humates Humic Acid, Fulvic Acid and Humin: Their Importance in Soil Fertility and

 ISSN 2072-3875

Plant Health. Mhtml;file;/ORGNIC MATTER.mht.

27- **Rout, G. R. and S. Sahoo.2015.** Role of iron in plant growth and metabolism. Reviews in Agricultural Science,3:1-24.

28- **Salunkhe. D.K. Bhat. N.R Desai B. B. 1989.** Postharvest Biotechnology of Flower and Ornamental Plants. Mahatma Phule Agriculture University. Rahuri District. India.

29- **Taiz L. and E. Zeiger.2006.** Plant Physiology. 4^nd^ed. Sinauer Associates Inc. Publishers. Sunderland, Massachusetts. USA.

 ISSN 2072-3875